

CLAIMS

1. A leak detector for detecting leakage of liquid stored in a tank based on fluctuation in a level of the liquid, comprising:

5 a liquid inlet/outlet portion through which the liquid flows in and out;

a flow-rate measuring unit arranged at an upper end of the liquid inlet/outlet portion and configured to measure an amount of flow occurring along with the fluctuation; and

10 a liquid retaining portion positioned above the flow-rate measuring unit and including a space in which liquid that has flown in through the liquid inlet/outlet portion is retained, wherein

a lower end of the leak detector is detachably
15 attached to a bottom plate of the tank, and

an upper end of the leak detector is arranged in such a manner that the space of the liquid retaining portion communicates with an interior of the tank, and is supported in a through opening provided in a top plate of the tank in
20 such a manner that the leak detector is movable in a vertical direction.

2. A leak detector for detecting leakage of liquid stored in a tank based on fluctuation in a level of the liquid,

25 comprising:

a liquid retaining portion including a space configured to retain liquid flown into the leak detector, the liquid flown being a part of the liquid in the tank;

a flow path portion through which the space of the
30 liquid retaining portion in communicates with an interior of the tank and through which the liquid flows in and out of the leak detector along with the fluctuation;

a flow-path opening/closing unit configured to freely

open and close at least one end of the flow path portion;
a flow-rate measuring unit configured to measure an
amount of liquid flowing inside the flow path portion; and
a calibrating unit configured to calibrate the flow-
5 rate measuring unit.

3. A leak detector for detecting leakage of liquid stored
in a tank based on fluctuation in a level of the liquid,
comprising:

10 a liquid retaining portion including a space in which
liquid flown therein is retained, the liquid flown being a
part of the liquid in the tank;

a flow path portion through which the liquid flows
between the space of the liquid retaining portion and an
15 inside of the tank along with the fluctuation;

a flow path opening/closing unit configured to freely
open and close at least one end of the flow path portion;

a flow-rate measuring unit configured to measure an
amount of the liquid flowing inside the flow path portion;

20 and

a calibrating unit configured to calibrate the flow-
rate measuring unit, wherein

a lower end of the leak detector is detachably
arrested to a bottom plate of the tank, and

25 an upper end of the leak detector is configured such
that the space of the liquid retaining portion is in
communication with an interior of the tank, and is
supported in a through opening provided in a top plate of
the tank in such a manner that the leak detector is movable
30 in a vertical direction.

4. The leak detector according to claim 1 or 3, wherein
the lower end of the leak detector is detachably

arrested to the bottom plate of the tank with a magnet.

5. The leak detector according to claim 1 or 3, wherein
the upper end of the leak detector is supported in the
5 through opening through an elastic member.

6. The leak detector according to claim 2 or 3, wherein
the flow-rate measuring unit includes
at least one temperature detecting unit
10 configured to detect temperature of liquid inside the flow
path portion;

a heating unit configured to heat the liquid
inside the flow path portion; and

a controlling unit configured to control heating
15 temperature of the heating unit for heating the liquid so
that the temperature of liquid inside the liquid retaining
portion and the temperature of the liquid inside the flow
path portion become equal.

20 7. The leak detector according to claim 2 or 3, wherein
the calibrating unit calibrates the flow-rate
measuring unit based on an output signal corresponding to
temperature of liquid being inside the flow path portion
without flowing.

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8. The leak detector according to claim 1 or 3, further
comprising

a protective member configured to protect the flow-
rate measuring unit and the liquid retaining portion from
30 the liquid, and arranged outside the flow-rate measuring
unit and the liquid retaining portion, wherein

the protective member is formed with a metal having a
thermal expansion coefficient in a range such that a

distance between the flow-rate measuring unit and the bottom plate is maintained invariant.

9. The leak detector according to claim 8, wherein
5 the protective member is formed with a material identical to a material of the tank.

10. The leak detector according to claim 1, further comprising an intermediate member arranged between the leak
10 detector and the bottom plate, and formed with a magnetic material.

11. The leak detector according to claim 1, wherein the flow-rate measuring unit includes
15 a flow path portion for the liquid arranged between the space of the liquid retaining portion and the liquid inlet/outlet portion;
at least one temperature detecting unit configured to detect temperature of liquid inside the flow
20 path portion;
a heating unit configured to heat the liquid inside the flow path portion; and
a controlling unit configured to control heating temperature of the heating unit for heating the liquid so
25 that the temperature of liquid inside the liquid retaining portion and the temperature of the liquid inside the flow path portion become equal.

12. The leak detector according to claim 2 or 3, wherein
30 the flow path opening/closing unit includes a solenoid valve and is configured to open and close at least one end of the flow path portion.

13. A leak detecting system comprising:

a leak detector configured to detect leakage of liquid stored in a tank based on fluctuation in a level of the liquid, and including

5 a liquid inlet/outlet portion through which the liquid flows in and out;

a flow-rate measuring unit arranged at an upper end of the liquid inlet/outlet portion and configured to measure an amount of flow occurring along with the

10 fluctuation; and

a liquid retaining portion positioned above the flow-rate measuring unit and including a space in which liquid that has flown in through the liquid inlet/outlet portion is retained, wherein

15 a lower end of the leak detector is detachably arrested to a bottom plate of the tank, and

an upper end of the leak detector is arranged in such a manner that the space of the liquid retaining portion communicates with an interior of the tank, and is

20 supported in a through opening provided in a top plate of the tank in such a manner that the leak detector is movable in a vertical direction; and

a controller configured to control driving of the leak detector.

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14. A leak detecting system comprising:

a leak detector configured to detect leakage of liquid stored in a tank based on fluctuation in a level of the liquid, and including

30 a liquid retaining portion including a space configured to retain liquid flown into the leak detector, the liquid flown being a part of the liquid in the tank;

a flow path portion through which the space of

the liquid retaining portion in communicates with an interior of the tank and through which the liquid flows in and out of the leak detector along with the fluctuation;

5 a flow-path opening/closing unit configured to freely open and close at least one end of the flow path portion;

a flow-rate measuring unit configured to measure an amount of liquid flowing inside the flow path portion; and

10 a calibrating unit configured to calibrate the flow-rate measuring unit; and

a controller configured to control driving of the leak detector.

15 15. A leak detecting system comprising:

a leak detector configured to detect leakage of liquid stored in a tank based on fluctuation in a level of the liquid, and including

20 a liquid retaining portion including a space in which liquid flown therein is retained, the liquid flown being a part of the liquid in the tank;

a flow path portion through which the liquid flows between the space of the liquid retaining portion and an inside of the tank along with the fluctuation;

25 a flow path opening/closing unit configured to freely open and close at least one end of the flow path portion;

a flow-rate measuring unit configured to measure an amount of the liquid flowing inside the flow path portion; and

30 a calibrating unit configured to calibrate the flow-rate measuring unit, wherein

a lower end of the leak detector is detachably

arrested to a bottom plate of the tank, and

an upper end of the leak detector is configured such that the space of the liquid retaining portion is in communication with an interior of the tank, and is

- 5 supported in a through opening provided in a top plate of the tank in such a manner that the leak detector is movable in a vertical direction; and

a controller configured to control driving of the leak detector.